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REQUEST FOR RESISTRATION OF UTILITY MODEL

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[Attention] Commissioner, Patent office

5 [Title of the Invention]

LASER ANNEAL DEVICE

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[List of Attachment]

20 (1) Specification 1

(2) Drawing 1

(3) Letter of Procuration 1

(4) Duplicate of Patent Application 1

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[Name of Document] Specification

[Title of the Invention] LASER ANNEAL DEVICE

[Scope of Claim]

A laser anneal device comprising:

- 5       a laser which has enough energy to anneal a semiconductor, a metal and an insulating film;
- an optical system which realizes this laser with a desired beam diameter;
- a mask for annealing a desired region of a sample;
- an optical system and an aligner mechanism for alignment of a sample and a
- 10   mask; and
- a scanning system for irradiating a whole mask with a laser beam.

[Detailed Description of the Invention]

The present invention relates to a device which laser-anneals a desired region of a semiconductor, a metal and an insulating material with exact dimensional precision.

- 15       Fig. 1 is a diagrammatic illustration showing the conventional laser anneal device. In the drawing, reference number 1 shows a TV monitor or a microscope, reference number 2 shows a wafer, reference number 3 shows a stage, reference number 4 shows a laser source, reference number 5 shows a reflective mirror, reference number 6 shows a beam collimator, reference number 7 shows a laser beam, and reference
- 20   number 8 shows a condenser lens. The laser beam, whose diameter changes from several tens of  $\mu\text{m}$  to several cm according to the type of laser, is a mechanism to laser-anneal by irradiating the whole wafer 2, with a scanning mechanism attached to the reflective mirror 5 or the stage 3, no matter how long the diameter is. Therefore it is required that a mask which has high reflectance or poor laser permeability, for
- 25   instance a material such as Al, is made on the wafer 2 to cover a non-objective region from the laser beam and so troublesome steps such as forming mask material and patterning are required, in order that only an objective region of a semiconductor is annealed.

- In the present invention, to remove the conventional defect as above and to
- 30   improve dimensional precision of patterning, a laser anneal device is equipped with an

aligner mechanism and both patterning and anneal are performed at once. Hereinafter, an embodiment of the present invention is described in detail with reference to the drawings.

Fig. 2 is a block diagram showing an embodiment of the laser anneal device of the present invention. Reference number 21 shows a microscope monitoring alignment of a wafer 22 and a mask 23 which covers an undesired region from a laser beam, reference number 24 shows an aligner mechanism to position of the mask 23 and the wafer 22, reference number 25 shows a stage, reference number 26 shows a laser source, reference number 27 shows a reflective mirror, reference number 28 shows a beam collimator, reference number 29 shows a laser beam and reference number 30 shows a condenser lens.

Next, the operation is described.

At first an assigned region of the wafer 22 and the mask 23 are aligned with the aligner mechanism 24 while monitoring with the microscope 21. The aligner mechanism 24 may be set on the stage 25. Additionally the aligner mechanism 24 requires at least mechanisms for X-Y and rotation, and the wafer 22 and the mask 23 are stuck together or have a gap of several  $\mu\text{m}$  inbetween. After positioning the mask, the laser source 26 is operated to irradiate whole surface of the mask 23. The scanning mechanism is set on the reflective mirror 27 or the stage 25. The wafer 22 and the mask 23 are operated together, provided that the scanning mechanism is set on the stage 25. This enables only an assigned region of the wafer 22 to be laser-annealed, with an unassigned region covered with the mask 23 from the laser.

As above, only an assigned region of a semiconductor can be laser-annealed by providing the aligner mechanism of an exposure equipment employed in a normal photo etching step to a laser anneal device. Therefore steps in the case of annealing an assigned region of the semiconductor by the conventional laser anneal device, that is, troublesome steps such as (1) forming a mask material on a semiconductor substrate, (2) photolithography for an assigned region and (3) etching an assigned region, are not required, and patterning and laser-annealing can be performed at the same time, and so the process can be simplified. Additionally, dimensional precision of patterning can be

improved because of light self-alignment using a mask.

Fig. 3 is a block diagram showing another embodiment of a laser anneal device according to the present invention. In the foregoing embodiment, a structure as a aligner mechanism, where a wafer and a mask are stuck together or have a gap of  
 5 several  $\mu\text{m}$  inbetween, was described, and the process can be also simplified by using a projection-type structure as this embodiment.

In the diagram, reference number 31 shows a microscope, reference number 32 shows a wafer, reference number 33 shows a mask, reference number 34 shows an aligner mechanism, reference number 35 shows a stage, reference number 36 shows a  
 10 laser source, reference number 37 shows a reflective mirror, reference number 38 shows a beam collimator, reference number 39 shows a laser beam, reference number 40 shows a condenser lens, and reference number 41 shows a lens condensing the laser beam 39 on the mask 33. The difference from the foregoing embodiment is that the laser beam 39 illuminates the wafer 32 after passing through the mask 33 and then  
 15 through optical systems such as the reflective mirror 37 and the condenser lens 40, but the aligner mechanism 34, the scanning system and the like are the same.

The process in the foregoing embodiment can be simplified and dimensional precision for annealing a desired region can be improved by such a structure.

As described in detail above, in the present invention, only a desired region of  
 20 a sample can be annealed with exact dimensional precision and a process can be simplified, because of the laser anneal device equipped with an aligner mechanism.

#### [Brief Description of the Drawings]

Fig. 1 is a block diagram showing the conventional laser anneal device, Fig. 2 is a block diagram showing one embodiment of a laser anneal device according to the  
 25 present invention, and Fig. 3 is a block diagram showing the other embodiment according to the present invention.

#### [Description of the code]

21, 31...microscope  
 22, 32...wafer  
 30 23, 33...mask

24, 34...aligner mechanism

25, 35...stage

26, 36...laser source

27, 37...reflective mirror

5 28, 38...beam collimator

29, 39...laser beam

30, 40, 41...condenser lens

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